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SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS MADE BY THE [REDACTED]
ON THE HUMAN FACTORS PROGRAM

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A. - FY-66 Program (Completed in May 1967)

Task #1 - The State-of-the-Art Review

The state-of-the-art review provided an overview of the status of human factors research in the area of image interpretation. The results of this survey show that a significant gap exists between experimentally established knowledge of the factors affecting photo interpreter performance and the needs for criteria and guidelines directly relevant to programs aimed at improving that performance.

Task #2 - Illumination Study

This study investigated the effects of two color temperatures of illumination (2360°K and 5500°K) on target detection and mensuration performance, and on visual acuity. The result of this study indicated that illuminance color temperatures of 2360 and 5500°K, singly or mixed, for display and ambient, had no overall effect on interpreter performance. It is concluded that illumination color temperature within these ranges has no significant effect on interpreter performance.

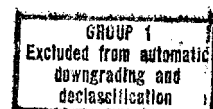
Task #3 - Visual Fatigue Study

This effort was to develop a device for the dynamic recording of ocular changes associated with visual accommodation in photo interpretation work. The ultrasonic technique which was studied was proved to be feasible but the engineering implementation presented some unsolved problems. In the judgment of the [REDACTED] a full-scale development support should await the solution of these implementation problems.

Task #4 - Image Quality Study

The basic intent of this program was to investigate a proposed quantitative measure of photographic image quality called the modulation transfer

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function area (MTFA), sometimes called the threshold quality factor. The results of the study have shown a promising correlation between MTFA and photograph quality. This study will be completed under the FY-67 program, but this effort will be discontinued at that time because the NPIC requirement for producing qualitative ratings of image quality has not been defined as was anticipated in 1966.

Task #5 - Pacing and Teaming of Photo Interpreters

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The major purpose of this two-part investigation was to assess the quantitative effects of certain work pacing schedules (Phase A) and interpreter team structures (Phase B) on the accuracy and completeness of photo interpreter performance, with a view toward improved use of interpreter personnel. Using the test results, [] arrived at the following recommendations:

1. No basis was found for recommending external pacing as an operational procedure.
2. If accuracy is the paramount system requirement and is to be attained even at the expense of completeness, then parallel teams should be used with only agreed responses scored.
3. Series interpreter teams seem to be the most promising compromise to achieve both accuracy and completeness, but this should be subjected to additional experimental verification.

Task #6 - Review of Sponsor Operation

This small task was to ensure that the cleared contractor personnel were fully cognizant of NPIC's procedures, imagery, objectives and requirements (actually an educational process for the contractor).

Task #7 - State-of-the-Art Recommendations

A review was made of the state-of-the-art to determine if there were principles, techniques, or equipment design improvements currently available that could be immediately applied to improve the Center's performance. Areas in which it was felt that immediate improvement would be realized were:

1. Light Tables -- Four basic human factors problems concerning the light tables were selected for recommended improvements:
 - a. Changes to improve the viewing position of the interpreter while using the microscope;
 - b. Control of glare from the broad, unused portions of the table;
 - c. Improvement of the knee-space by relocation of obstructing and potentially injurious equipment;
 - d. Modification of a design feature that tends to catch and hold film during transport.
2. Miscroscopes
 - a. Improved illumination of the stage by use of edge-lighting;
 - b. Minor modification to incorporate a rapid-pointing feature to assist in positioning.
3. Lighting -- Modification of the overall facility lighting concept to reduce glare and increase visual efficienct.

All of the above recommendations have been reviewed by TDS and most have been accepted for consideration in design of equipment.

Task #8 - Interpreter Performance Measures Definition

The goal of this task was to plan the development of a performance test that could be used to make meaningful comparisons between different conditions that might affect an interpreter's performance in his facility. This plan was designed, recommended and accepted, and the initial performance measures are now being conducted under the FY-67 program.

Task #9 - Stereo Study

This task is concerned with defining a program to investigate the use of stereoscopy as it relates to target detection and identification in NPIC image interpretation. The recommended design plan was accepted and the initial experiments are being conducted in NPIC under the FY-67 program.

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Task #10 - Associated Contractor Support

The associated contracts review provided technical human factors support to TDS to complement the efforts of the sponsor's other contractors on new equipment development and study programs. [] working directly with other major equipment contractors, identified human factors problems associated with their respective equipment designs. Many of the recommendations made by [] are being included in the designs.

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B. - FY-67 Program (Initiated in June 1967)

Most of the tasks in current program are still in progress. Results of all tasks along with recommendations are due on 1 March 1968. This program is as follows:

Task #1 - Interpreter Performance Measures

To develop performance test packages for assessing the relative accuracy, completeness, reliability and efficiency of interpreter performance. (In progress)

Task #2 - Technology Integration and Check-Out Facility

A utilization plan and facility design will be developed for T.I.C.O.F.. The primary purpose of the facility is to evaluate new procedures and equipment to be introduced into the Center's operation. T.I.C.O.F. now under consideration by senior staff personnel of the Center.

Task #3 - Interpreter/Machine Dynamics

To provide the specification and designation of human factor requirements to insure effective interpreter utilization of equipment and procedures resulting from sponsors' technical development programs. Several specific studies have already been completed and recommendations made. These are as follows:

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1. Maximum Scan Rate for the Automatic Stereo Scanner
This recommendation evolved from the design question, "What is the maximum rate at which imagery should be moved through the field of view of a P.I. operating the Automatic Stereo Scanner?" (now under development at [redacted])
From a human factors standpoint, this rate should not be so great as to reduce the probability of target detection or degrade the P.I.'s ability to perceive stereo; nor should the rate be so low as to reduce P.I. productivity and acceptability. [redacted] recommended that [redacted] design the instrument so that the maximum scan rate is 20°/second. This recommendation was forwarded to [redacted] and will be incorporated in their design.

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2. Operating Sequence for the Automatic Stereo Scanner
This is an interim recommendation about how the Automatic Stereo Scanner should be operated when it is placed in operation at NPIC. It was necessary to determine the operating sequence to insure that there were no design oversights which would obstruct an operator (or P.I.) from using the equipment to its fullest potential. This recommendation has been forwarded to [redacted] for their consideration and design review.

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3. Effect of Image Vibration on Vision
The Ultra High Precision Stereo Comparator (being developed by [redacted] when completed will be placed at NPIC in an environment which has many sources of small vibrations. Although vibration will be "damped-out" to a large degree, a question arose as to the effects of small vibrations on visual activity when the operator is viewing images at very high magnification. Magnification multiplies the apparent magnitude of small vibrations and therefore may preclude visual perception of small images. [redacted] was asked by TDS to recommend the limits of vibration which would affect human visual acuity at high magnifications. It was concluded that the vibration isolation system designed into the comparator by [redacted] is sufficient and that no re-design is necessary.

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4. Human Engineering Recommendations for the Design of the Ultra High Precision Stereo Comparator
 [] recommended several human engineering characteristics which should be considered in the overall design of the [] comparator. 25X1
 These recommendations related to the design of the magnification system, the reticle, accessibility and maintainability, the illumination system, the eyepieces, the chair, and the controls. 25X1
 These recommendations were forwarded to [] and most of the recommendations are included in the design.

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5. Human Engineering Recommendations for the Design Of the Advanced Rear Projection Viewer
 [] was asked by TDS to review the design plan for Nortronics Viewer and to recommend human engineering characteristics which should be considered in the design. These recommendations related to the illumination, viewing angles, viewing distances, provisions for easy handling of collateral materials, group viewing, ease of report writing and film loading.

Task #4 - Image Characteristics

This task will complete a project started in FY-66 which was to establish a measure of image quality as it relates to interpretability. (In progress)

Task #5 - Image Utilization

Compare the interpreters scanning performance under the alternate conditions of monoscopic viewing. and viewing with stereo available. (In progress)

Task #6 - Visual Mechanisms

Study of ocular mechanisms other than accommodation as predictors of the visual role in interpreter performance. (In progress)

Task #7 - Training Research

Develop a training package for NPIC microstereoscopes (a pilot program for equipment training to evaluate the feasibility of programmed instruction). (In progress)

Task #8 - Mensuration

To identify those errors of the mensuration process which are attributable to the human operator (vs., those attributable to equipment or imagery).
(In progress)

Task #9 - State-of-the-Art Review and Recommendation

To evaluate other research which may be applicable to NPIC. To develop a human engineering specification guide for NPIC equipment development. (In progress)

Task #10 - Consultation Services

The contractor shall serve as associate contractor and human factors consultant to the sponsor. (In progress)

C. - Other Recommendations

(1) Glare Reduction Lighting

This recommendation is based on the observation that photo interpreters are currently working under ceiling lights which produce excess glare which, as a consequence, produced visual fatigue and loss of efficiency. This recommendation is under further consideration by TDS. Before any positive recommendation is made to the Center, more information is required as to the most beneficial method of reducing glare. [] is performing some experiments at their home plant to determine this. A positive recommendation for a trial implementation in NPIC should be forthcoming during November.

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(2) Recruit Selection Test Battery

[] has recommended that we administer an existing test battery to potential photo interpreter recruits. This test was developed by the Army and appears to be potentially useful. The recommendation has been discussed with the recruiting people and with the Assessments and Evaluation Staff of OMS which has it under consideration.

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(3) Image Quality Assessment Catalogue

25X1 [] has recommended that we consider the development of a catalogue of images with varying qualities so that NPIC could judge the quality of incoming operationsl imagery. Although this recommendation has merit, it is not being pursued because there are several other methods of judging image quality which appear to have more merit. These other methods are currently being evaluated under contract to [] and NPIC.

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(4) Vibrating Rear Projection Screen

This recommendation relates to a method to reduce the detrimental grainy appearance of rear projection screens. This is an old concept which was evaluated by TDS several years ago. It was rejected by TDS because the increased total performance of a vibrating screen was too slight to justify the engineering complexities entailed in implementing it.

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